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INTEGRATION OF CIVILIAN AND
ARMY RESEARCH AND DEVELOPMENT

Leonard G. Robinson, Jr.
Lieutenant Colonel, Field Artillery

Date submitted: 24 May 1949

Integration of civilian and army research
and development, by Lt Col L. G. Robinson.
CGSC. 1948-49.

JUN 21 1965

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COMMAND AND GENERAL STAFF COLLEGE

4021

Department of Logistics
Fort Leavenworth, Kansas3 December 19481948STUDENT RESEARCH DIRECTIVE FOR SUBJECT NUMBER 8-11

STUDENT	<u>Robinson, Leonard G., Jr.</u>	Lt Col FA
(Name)		(Rank)

FACULTY ADVISOR	<u>Lt Col Collins</u>	245	24288
	(Name)	(Room No.)	(Tele. No.)

SUBJECT Organization to Integrate private industrial, foundational, and University Research and Development work into the Army technical program.

PURPOSE:

To determine what methods or organization should be established to integrate the results of private industrial, foundational, and university research and development work into the Army technical program and functioning.

SCOPE: (Brief outline of subject coverage)

1. Outline the present organizational and functional structure of the National Research and Development System to highlight the relationships between the Army Technical Program and private industrial, foundational, and university research and development work.

2. Illustrate how a representative research and development project initiated with the army technical program may be assigned to one or several military and civilian agencies for independent or collaborative research and development work, and how and through what channels the necessary authorization, controls, and coordination of effort, including timely exchange of information at the working level may be established.

3. Illustrate how the interested military agency (i.e. a research and development agency within one of the technical services) may receive timely information of work in progress on or work accomplished within a civilian research and development facility in connection with one of its own projects not necessarily related to the army technical program. For example, assume that a university or industrial metallurgical laboratory in connection with its own private research develops a process which would be of definite interest to the Ordnance Department. How does the Ordnance Department hear of this discovery and what agencies or channels are set up to ensure that the Ordnance Department does hear of it and receives timely information concerning it?

4. Analyze the effectiveness of the facilities or presently set-up in the National Research and Development System for the integration of private industrial, foundational and university research with the Army technical program.

5. Make specific recommendations for improvement of such integration.

NOTE TO STUDENTS:

1. The scope suggested above is intended as a guide only and is not to be construed as a limitation on the student's perusal of the subject. The student is encouraged to modify the above scope as he may find necessary to outline and define the specific problem he visualizes and proposes to develop in his research study.

(over)

2. The references below are furnished to give the student enough material with which to begin his research. It is anticipated that the student will make use of other available sources in order to give adequate scope to his subject, and to include latest developments pertaining to the subject.

REFERENCES:

COORDINATION: (Confer with the authors of these subjects for pertinent information and coordination)

REMARKS:

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1965

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Logistics Specialized Course
Regular Class 1948-1949

INTEGRATION OF CIVILIAN AND ARMY RESEARCH AND DEVELOPMENT

Leonard G. Robinson, Jr.
Lieutenant Colonel, Field Artillery

Date submitted: 24 May 1949

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COMMAND AND GENERAL STAFF COLLEGE
Department of Logistics
FORT LEAVENWORTH, KANSAS

24 May 1949

File No. 8-11

SUBJECT: Integration of Civilian and Army Research and Development

TO : Director, Department of Logistics,
Command and General Staff College

1. PROBLEM.--To determine what methods or organization should be established to integrate the results of private industrial, foundational and university research and development into the Army technical program.

2. ASSUMPTION.--That peacetime research and development will continue to receive a high priority in the national security program.

3. FACTS BEARING ON THE PROBLEM.--a. Owing to the inadequacy of military research and development prior to World War II, few of the improvements developed during the war were available for use before the war ended.

b. The present program reflects the nation's recognition that victory in a future war will depend on the ability of the United States to maintain its lead in the materials and techniques of war.

c. No peacetime agency exists for the coordination of civilian and military research activities on the national level.

d. In the army, organizational weaknesses exist which make integration of science and industry with the Army's technical program difficult to achieve.

4. DISCUSSION.--a. The failure of the national research and development organization to provide an adequate mechanism for policy direction and control at the top level impairs the effectiveness of the over-all program for national security.

b. Proposals to establish a National Science Foundation directly responsible to Congress for this purpose have failed. The Foundation would serve the following purposes: (1) promote closer collaboration of science, industry, and the government; (2) encourage the exploration of gaps in existing programs; (3) advance the devel-

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opment of scientific talent and the discovery of new scientific knowledge.

c. On the strategic level, the organization achieves its maximum effectiveness. The Research and Development Board prepares and supervises an integrated program for the Armed Forces. On the General Staff of the Department of the Army, the Research and Development Group, Logistics Division, performs a parallel function. The principal weakness is at the tactical level. The combat arms are without an agency qualified to review and pass expert opinion on equipment intended for their use or to coordinate and supervise the many interrelated responsibilities connected with developments in their respective branches.

5. CONCLUSIONS.--a. That a National Science Foundation designed to provide policy direction and control on the national level would be the most effective means to promote the integration of civilian and government research and development.

b. That the specialized nature of the combat arms requires at the top level in each branch a directing influence embracing a well-rounded experience in all the elements peculiar to the branch.

c. That this requirement can best be met by a council comprising qualified senior officers of the branch and representatives of the technical services and of the Research and Development Board, thereby providing liaison during the first phases of development.

6. ACTION RECOMMENDED.--a. That the Armed Forces renew their efforts to secure the establishment of a National Science Foundation.

b. That councils be established for each combat arm, with functions and organization as outlined in Amex 4 and Appendix 7.

c. That this study be approved and forwarded for consideration to the Director of Logistics, GSUSA.

Leonard G. Robinson Jr.
LEONARD G. ROBINSON, Jr.
Lieutenant Colonel, Field Artillery

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ANNEXES:

1. Draft Memorandum to Commandant, C & GSC
2. Draft letter of transmittal to Director of Logistics
3. Science and National Defense
4. The Research and Development System of the Army
5. Proposed Reorganization for Research and Development
6. Footnotes
7. Bibliography

CONCURRENCES:)

NONCONCURRENCES:)

CONSIDERATION OF NONCONCURRENCES:) Omitted
ANNEXES ADDED:)

APPENDICES:

1. Chart of Agencies affecting the Army R&D Program
2. Organization Chart, The Research & Development Board
3. Organization Chart, R&D Group, Log Div, GSUSA
4. Organization Chart, the Ordnance Technical Committee
5. Chart, Research & Development Procedures
6. Organization Chart, Army Field Forces
7. Proposed Organization Chart, Office, Chief, Army Field Forces

1949

APPROVED:

F. A. HENNING
Colonel, Field Artillery

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(ANNEX 1)

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COMMAND AND GENERAL STAFF COLLEGE
FORT LEAVENWORTH, KANSAS

SUBJECT: Integration of Civilian and Army Research and Development (File No. 8-11)
(IDENTIFY THIS MEMORANDUM SLIP WITH PAPERS TO WHICH ATTACHED.)

TO	SUBJECT MATTER	FROM DATE AND INITIAL
Commandant C & GSC	<p>1. I concur in the recommendations of the attached research study.</p> <p>2. Request that this study be transmitted to the Director of Logistics by means of letter (Annex 2) which has been prepared for your signature.</p>	FAH

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ANNEX 1

D R A F T

~~REF ID: A65124~~

COMMAND AND GENERAL STAFF COLLEGE

FORT LEAVENWORTH, KANSAS

~~REF ID: A65125~~

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SUBJECT: Integration of Civilian and Army Research and Development

TO : Director of Logistics
General Staff, United States Army
Washington 25, D. C.

1. The attached staff study, title: "Integration of Civilian and Army Research and Development", is transmitted to you for consideration and appropriate action.
2. The research study was prepared by a student in the College and concurred in by the Director, Department of Logistics. The recommendations made for the improvement of research and development procedures appear to have considerable merit.

M. S. EDDY
Lieutenant General, USA
Commandant

~~REF ID: A65126~~

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ANNEX 3

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SCIENCE AND NATIONAL DEFENSE

1. The relationship of technology to national security.

a. No lesson of World War II has been more completely taken to heart by the Armed Forces than that of the impact of science on modern warfare. The Air Force was able to operate day and night under practically all conditions; our armies were equipped with transportation which gave them an unparalleled degree of mobility; our forces were provided with protection against disease and wounds, as well as with hitherto unknown weapons such as the proximity fuze and the atomic bomb. It was Science that made all these possible.

b. In the early days of the war, however, before our tremendous scientific and industrial potential had come into full play, the results of our military effort were meagre indeed. Our enemies possessed many radical innovations, and our ability to retaliate was delayed almost to the danger point because of our lack of scientific preparedness. Today we recognize fully that victory in any future war will depend on our ability to maintain our lead position in the materials and techniques of modern war. There is even some reason to hope that our preparedness in this field may prevent another war by deterring potential aggressors. ~~from their base designs.~~

c. There are additional factors which have brought increased emphasis to the technological aspects of warfare. One of these is our manpower position. During the latter part of the war it had become painfully evident that as a nation we had reached the bottom of our manpower barrel. There is no reason to believe that we will be better off in that respect in any future conflict, unless we are willing to broaden the base of physical qualification for military service. Only by exploiting our technical superiority, therefore, can we hope to overcome our inferiority in manpower. Another consideration is the political one. Traditionally the United States must concede the strategic initiative to its enemies. We cannot start a "preventive war." Our only means of effectively countering this disadvantage is

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to possess, at the beginning of a war, weapons which are superior to those of our enemies in order that we may seize the technical initiative and put the scientific potential of the enemy on the defensive.

2. The scope of the Army's research and development program.

a. The emphasis which is now being given to scientific research and development by the Army is demonstrated clearly by the outlay of \$100,000,000 per year in this field.¹ Approximately one-third of this amount is for work done in Army installations. The remainder goes to industrial organizations, universities, and foun-dational research agencies.²

b. The objective of Army research and development is to "apply the results of scientific analysis and research to the development of the most advanced materiel, techniques, and countermeasures in the execution of the military policy of the United States."³ Stated in more specific terms, the ultimate goal of the Army's research and development program is to insure that the weapons, equipment, and techniques employed by the Army in combat operations are superior to those of any potential enemy.

c. In the attainment of the above objective, experience has demonstrated that the best results accrue only when the program is conducted in accordance with the following principles:⁴

(1) Scientists and engineers responsible for basic research must be given the greatest possible latitude in executing a basic research program.

(2) In peacetime, emphasis must be placed on basic and applied research rather than on minor improvements in existing equipment.

(3) Projects involving basic research should remain unclassified insofar as possible in order to permit the free exchange of information upon which productive research is dependent.

(4) Civilian research and development facilities must be put to the maximum use; and military facilities must not be

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established when comparable civilian facilities are available to meet the Army's requirements.

(5) All available intelligence sources must be utilized to make a continuing evaluation of foreign developments in order to insure United States superiority in materiel.

(6) Since development and production take years, research and development planning must look ahead if the maximum results are to be derived.

d. The foregoing principles have been recognized as fundamental by the Department of the Army, and every effort has been made to base research and development organization and policies thereon.

The basic policies governing the current Army program are as follows:⁵

(1) Peacetime research and development programs will be given the highest priority.

(2) The greatest energy will be directed toward the development of those items which give promise of exerting a major influence on the Army's mission.

(3) Development programs will be based generally on the reported needs of the using agency, whose recommendations will be given careful consideration.

(4) A minimum of expense and effort will be devoted to improving existing weapons. (This policy recognizes, however, the need for improvements to insure superiority to our competitors, while permitting the simultaneous development of items of advanced design and superior combat effectiveness).

(5) Scientific talent within the Army will be augmented by hiring civilian scientists.

(6) The greatest possible freedom will be given to scientists in carrying out research.

(7) Civilian educational institutions, research foundations, commercial and industrial laboratories, and qualified consultants will be utilized to the maximum for the solution of research and development problems.

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(8) Adequate laboratories, proving grounds and test boards will be maintained and operated for conducting research and development activities; but facilities will not be established which can be provided by civilian organizations.

e. The foregoing policies are designed to make the most effective equipment available to our troops for the maintenance of a superior military policy. The vital importance of the program based on those policies requires the utmost attention to the long-range planning upon which the success of the program must depend.

f. All Army activities are affected by research and development planning. One of the most important factors is the influence of strategic plans on the development of new materiel and vice versa. Close and continuous liaison between the Plans and Operations Division, GSUSA, and the Research and Development Group of the Logistics Division is therefore essential. Similarly, the Organization and Training Division is vitally concerned with research and development planning because of the need for formulating tactical doctrine and prescribing training in the employment of the new equipment and techniques which are developed. The Intelligence Division also plays a part in the Army's technical program by informing the Logistics Division of new developments in foreign countries. This information is necessary in order to insure that the development of countermeasures is included in the program and that our end items are superior to those of foreign nations.

3. The need for organization.

a. The problems which arise in the field of science and its relationship to the national defense require wise solution. Not only must the needs of the Armed Forces be carefully considered and balanced, but the needs of the nation as a whole must also be weighed against military requirements if the results of our scientific effort are to be effective.⁶ The mechanism for providing the essential elements of sound policy is sound organization. From sound policy stems an effective program, and together they furnish the necessary guideposts

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for research and development operations as for any other military activity. Organization provides also the control which is essential to operating efficiency.

b. We must insure that we get the maximum results for the money and effort spent, and this can be achieved only through the proper allocation of functions, thorough coordination, careful supervision, collaboration, the interchange of information, the evaluation of activities, and wise budgeting.

c. At the government level the need for machinery to achieve a unified policy for science has long been recognized.⁷ The lack of such machinery has given rise to weaknesses in the formulation and execution of research programs, but efforts are now under way to meet the need. Within the framework of the Army's organizational structure for research and development the essential elements for the integration of science and the military technical program are present. There are weaknesses in the method of application, however, but they are not so readily apparent nor are they generally recognized, and consequently the integration is not always as effective as it might be. Before discussing the weaknesses of the Army's structure, an examination of the entire federal research and development organization is in order.

4. The organization and functional structure for research and development.

a. (1) Organization for research and development on a nation-wide scale may be divided into four categories: governmental, quasi-governmental, private civilian, and military (Appendix 1).

(2) The governmental agencies which most directly affect the Army's technical program are as follows:⁸

The Inter-departmental Research and Development Committee

The Atomic Energy Commission

The National Inventors Council

The Publication Board, Department of Commerce

b. One of the oldest existing agencies is the quasi-governmental National Academy of Science together with its operating agency,

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the National Research Council. Its primary function is advisory, and the departments of the government are expected to take the initiative in asking its assistance. This is accomplished by contracting with the Academy to have the Council establish committees and subcontract with organizations best suited to conduct the desired research. The Academy's membership consists of several hundred representatives from scientific and technical societies, as well as from government bureaus. Its financial support is derived chiefly from gifts and special funds. The expenses of its investigations for the government are met from appropriations by the departments concerned.

c. (1) The Interdepartmental Committee on Research and Development, appointed by the President, consists of representatives of those federal departments most vitally interested in research and development. Its function is to coordinate federal research, to strengthen the machinery for planning, and temporarily to fill the gap in the integration of civilian research activities with the national research program, pending the establishment of more effective machinery.

(2) The purpose of the Atomic Energy Commission is to develop and utilize atomic energy for the public welfare, to increase standards of living, and to promote world peace. The military aspects of atomic research are given consideration through the Commission's Division of Military Application, whose director is a member of the Armed Forces, and through a Military Liaison Committee (Appendix 1). This structure gives the Armed Forces a voice in the development, control, and use of atomic bombs and fissionable material.

(3) The National Inventors Council was created to examine and evaluate proposals and inventions applicable to military uses. Ideas considered to have merit are referred to the appropriate service for test and study with a view to adoption.

(4) The Publication Board of the Department of Commerce collects and disseminates to civilian science and industry technical reports resulting from government and foreign research which are suitable for public release.

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(5) In addition, a large number of agencies operate under other government bureaus. Their relationship to national defense is not so clear-cut as those which have been discussed above.

d. (1) The National Defense organization for research and development is coordinated at the highest level by the Research and Development Board (Appendix 2). The function of the Board is to prepare a unified and integrated program of research and development for the Armed Forces and to eliminate any undesirable duplication of effort. The Research and Development Board is a military organization composed of six high-ranking military officers who represent the using and developing agencies of the three services and presided over by a civilian chairman. Decisions are made by the Board as to the distribution of effort and the relative emphasis to be placed on projects. These decisions are based on the investigations and recommendations of the Board's committees, which are organized on a semi-permanent basis according to the urgency of the problems that arise. Each committee is composed of three civilians and two officers from each of the military services. The civilians are present to bring their expert knowledge of their particular fields to the problems and to act as a balance wheel among the services.⁹

(2) Also on the National Military Establishment level is the Armed Forces Special Weapons Project (AFSWP) (Appendix 1), which was organized to discharge all military service functions connected with atomic energy. Liaison with the Atomic Energy Commission is obtained through membership on the Military Liaison Committee.¹⁰

e. The research and development organization of the Department of the Army accents applied research: the canalizing of effort toward definite objectives; and development: the application of the result to the creation of new material and techniques for military use. Alive to the scientific nature of modern war, the Army attempts to maintain close relationships with science and industry and solicits the aid and participation of outstanding scientists and engineers in the planning and conduct of its research and development program.¹¹

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(1) The Secretary of the Army obtains the advice of eminent scientists, industrialists, and educators through the Army Research Advisory Panel which investigates major problems of Army-wide interest. Additional coordination is performed by the Assistant Secretary of the Army, who represents the Secretary in dealing with other federal agencies and with the public in matters relating to research and development. To assist the Assistant Secretary of the Army, the Special Scientific Adviser to the Secretary of the Army, working closely with the Research and Development Board and the Deputy Director of Logistics for Research and Development, makes recommendations on major technical policies relating to the Army's research and development program.¹²

(2) In addition to his other functions, the Director of Logistics is the advisor to the Secretary of the Army and the Chief of Staff on matters concerning research and development on the general staff level. A Research and Development Group (Appendix 3), under a Deputy Director of Logistics, is included in the organization of the Logistics Division. Within this group is centered the general staff responsibility for the development of new materiel and techniques in accordance with new strategic concepts and the latest advances in science, as well as the formulation and supervision of the over-all research and development programs of the Army.¹³

(3) The fulfillment of these programs is the responsibility of the Technical Services. On the staff of each Technical Service Chief is a research and development section whose function is to supervise research and development on items peculiar to its service conducted by the technical service facilities located throughout the country. Coordination with the using agencies is effected by a specialized technical committee permanently established within each technical service on which all interested arms and services are represented (Appendix 4).¹⁴

(4) The Chief, Army Field Forces, recommends the initiation of research and development projects for equipment intended

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for the use of the combat arms.¹⁵ These recommendations are based on the preliminary investigations of the Development Section, Office, Chief of Army Field Forces, and its four Army Field Force Boards.

The functions of these boards are to:

- (a) Evaluate recommendations for the development of new equipment or the improvement of existing equipment employed by units of the field army;
- (b) Review and study foreign equipment;
- (c) Formulate military characteristics;
- (d) Maintain contact with development agencies;
- (e) Perform users' service tests;
- (f) Recommend modification of items tested;
- (g) Recommend reclassification of standard items;
- (h) Recommend the basis of issue for newly standardized items;
- (i) Prepare training literature on drill;
- (j) Observe and review reports of performance.

5. Weaknesses of the over-all system.

a. Since the end of the war a number of studies have been made to determine methods whereby the national structure for research and development might be strengthened. The President's Scientific Research Board, headed by Dr. John R. Steelman, and the Industrial College of the Armed Forces, through various committees, have been the principal protagonists of reform. The fundamental weaknesses are recognized, and there is general agreement on the nature of the measures required to overcome the difficulties arising therefrom.

b. The areas of difficulty in the existing over-all design for research and development which create obstacles to the integration of science and national security are:

- (1) The absence of a top agency for policy coordination and direction;
- (2) The shortage of scientific manpower;
- (3) The depletion of our store of basic scientific knowledge.

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(4) The lack of adequate machinery for the correlation and dissemination of scientific information.¹⁶

c. The remedy upon which students of the problem appear to be in accord is the establishment of a "National Science Foundation," directly responsible to the Congress for coordinating and promoting scientific research in the United States. The bill to create this Foundation, passed by Congress in 1947, was vetoed by the President because of the allocation of authority of which he did not approve.¹⁷ It is hoped, however, that an acceptable bill will be passed in the near future.

d. The military components of the national structure for research and development provide adequate machinery for policy direction in the Research and Development Board, the Research and Development Group of the Logistics Division, and comparable agencies in the other services. There is no such agency, however, on the national level. The proposed National Science Foundation would serve to define objectives, review the available resources, and establish the necessary devices for the employment of those resources to attain the objectives of the national research and development policy.¹⁸ In this way, a balance among conflicting programs would be achieved, the proper emphasis would be determined, and functions would be allocated among the interested agencies, thereby eliminating waste and undesirable duplication. Closer collaboration of science, industry, and the government would be promoted, and the exploration of gaps in existing programs would be encouraged.

e. Another important purpose which the Foundation could serve would be as a powerful aid in providing the scientific personnel which are essential to an adequate program at all levels.¹⁹ Unfortunately, the number of trained scientists has not kept pace with expanding research and development budgets. The development of scientific talent over a much broader area is imperative if new techniques are to be exploited to the utmost.

f. Of equal importance to an increased number of scientists

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is an increased amount of fundamental knowledge on which to build new developments.²⁰ The proportion of pure research to applied research in the United States is a matter of grave concern.²¹ Under the National Science Foundation it will be possible to promote the discovery of new scientific knowledge by the expansion of fundamental research.

g. One of the most pressing problems concerning the integration of civilian and governmental research activities is the difficulty of providing a free flow of scientific information. The machinery for the collection, evaluation, and exchange of information is inadequate to meet the demands of progress.²² The establishment of a national scientific reference service to handle the vast volume of information, to store, index, and catalogue it, and to make it available to agencies which can use it to advantage would be a proper responsibility of the National Science Foundation. Here too could be centralized the information regarding available facilities and their capabilities with a resulting elimination of much duplicated and costly effort.

6. Summary

a. An effective national program of research and development is necessary to

(1) insure the supremacy of our armed forces in the weapons and techniques of modern war,

(2) offset our relatively low manpower potential,

(3) safeguard the scientific initiative achieved during World War II.

b. The Army's research and development policy recognizes the importance of the contribution of science and industry to the attainment of the above objectives.

c. The organization for research and development must include agencies for the coordination and direction of policy at all levels.

d. Outside the military sphere, the government organization for research and development fails to provide an adequate mechanism

for policy direction and control.

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e. The weaknesses of the structure for research and development at the national level and the resulting problems are recognized and measures are currently under consideration which are designed to overcome the obstacles to effective integration of civilian and government effort.

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COMMAND AND GENERAL STAFF COLLEGE

FORT LEAVENWORTH, KANSAS

ANNEX 4

THE RESEARCH AND DEVELOPMENT SYSTEM OF THE ARMY

²³

1. The determination of requirements.

a. The basis for the initiation of the majority of research and development projects in the Army is the establishment of a firm requirement for a new or improved item of equipment. The procedure is formalized by the official approval by the Director of Logistics of a technical committee recommendation that a project to develop the item be undertaken. The recommendations of the technical committee are based on the results of a preliminary investigation by the using service to determine the desirability and feasibility of the subject item.

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b. The impetus for the investigation may come from any of a number of sources (Appendix 5). In the combat arms, for example, wartime experience with a particular weapon may have indicated the need for better accuracy, an increased rate of fire, lighter weight, or greater durability. The factor to be considered in the determination of a requirement in the instance mentioned is whether it would be feasible to achieve the improved performance by means of modification of the existing weapon or by applying the most recent technical advances to the development of an entirely new weapon.

c. Using the above illustration, the procedure would be as follows: The Chief, Army Field Forces, through his ~~Deputy~~ ^{the} Chief ~~for~~ Development who heads ^{of} the Development Section, would assign to the appropriate using agency, normally one of the Army Field Forces Boards (Appendix 1), a project to conduct the preliminary study. The Board's study will include a detailed analysis of the factors bearing on the problem and appropriate recommendations regarding the course of action to be pursued. These recommendations will represent the considered opinion of a group of experienced officers of the using arm, who during

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the course of the investigation have been in close consultation with representatives of the appropriate technical service, as well as with any other agencies, military or civilian, which may have worthwhile contributions to make. The comments of these agencies are included in the Board's report.

d. The report is now forwarded to the Development Section, Office, Chief, Army Field Forces, for review.^A If the conclusions and recommendations of the Board are favorably considered, the report is forwarded to the Research and Development Group, Logistics Division, with the statement that a firm requirement exists and the recommendation that a project be initiated to develop the required weapon. The report will usually include military characteristics, a statement of the performance qualities expected in the item under consideration.

2. The development phase.

a. Upon approval by the Director of Logistics of a research and development project, the matter is referred to the technical service chief within whose scope the item falls. In the minutes of the technical committee meeting at which the subject is discussed, the military characteristics are made a matter of record, budgetary considerations are met, and the project is assigned to a development facility for execution. The facility may be military, civilian, or a combination of both. Copies of the minutes of the meeting are distributed to all concerned for their information and guidance.

b. After a study of the problem by the development agency, tentative designs are submitted to the using agency for study and comment. Occasionally, military characteristics formulated by the using agency are beyond the capabilities of the developing facility to fulfill, either because they are too ambitious or exacting, or because they are beyond the present state of the art. The difficulty may be resolved by modification of the military characteristics, or it may be necessary to conduct supplementary research to arrive at a solution. Since excessive delay will usually result from the latter course, the project is frequently directed toward the development of

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an interim item which will serve as a vehicle for testing those characteristics which can be met.

c. During the design phase, close coordination between user and engineer is essential to permit adjustments between the desires of the user and the capability of the developer to meet them. Major changes in military characteristics for combat arms equipment require the approval of the Chief, Army Field Forces.

d. When the using and developing agencies are in accord on the design, detailed drawings are completed, and the construction of a "mock-up" is undertaken. It is important that coordination between the user and the designers continue during this phase, because it is when the model begins to take form that inherent deficiencies in the design from the user's viewpoint become apparent. It may be advisable for the engineers to visit the user on his home ground in order to have specific problems physically demonstrated.

e. Final approval of the completed mock-up leads to the construction of a "pilot model," the working prototype which becomes the subject of engineering and service tests. The engineering test determines whether the item meets the mechanical performance criteria established in the engineering specifications. The service test determines whether the military characteristics have been met and whether the equipment is suitable for adoption and use by the Army as a standard item.

f. It is the function of the Army Field Forces Board to conduct service tests of those items intended for use in the field army. The organization of the boards and the allocation of responsibilities to them reflect the requirements of the various components of the field army. Related fields of interest are grouped as nearly as possible under the same board.

g. The results of the tests, which are conducted under field conditions and are exhaustive, are recorded in a report which becomes the basis for standardization procedures (Appendix 5) if the item is considered suitable. If the test reveals deficiencies, the report

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may recommend modifications and further test or cancellation of the project. The board's recommendations are again subject to review by the Development Section, Office, Chief, Army Field Forces prior to being forwarded to the Director of Logistics for action.

3. Discussion. Although the above procedure may vary slightly with the type of project, the broad principles are uniform in their application and appear at first glance to be sound. In practice, however, difficulties arise which point to defects in the system. The general nature of the existing deficiencies are as follows:

a. One area of difficulty is encountered during the investigative phase, particularly in the combat ~~areas~~^{arms}, and concerns the solicitation of technical advice and opinion from civilian sources. The machinery designed to assist the using agency in establishing appropriate contacts to obtain needed information is not entirely satisfactory. This function is essentially one of coordination, but its success depends on a sympathetic interest in the problem, a knowledge of where the information is to be found, and an over-all accountability for results. Unless this coordinating influence is felt in the initial stages of the investigation, the conclusions of the Board may be based on an incomplete analysis.

b. Responsibility for the detailed review of reports of studies and tests made by the Army Field Forces Boards is delegated by the Chief, Developments Section, OCAFF, to the division concerned -- Cannon and Fire Control, Light Weapons and Individual Equipment, etcetera -- as appropriate. The divisions are in reality small staff subsections consisting usually of two or three officers whose judgment springs from a background of experience not infrequently less than that of the senior members of the board. Since the Chief of the Developments Section must make decisions regarding development policies for all field army equipment, he must rely heavily on the recommendations submitted by his divisions. Decisions or recommendations leading to the development and adoption of weapons and equipment to be used by our troops in combat are obviously of the first importance.

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Not only must the purpose of each separate item be recognized and appreciated, but all the implications of its design, functioning, and the technique of its employment must be thoroughly understood as well. This requires the highest qualifications of broad, practical experience within the arm concerned, together with judgment and a considerable degree of technical knowledge. These are the essentials upon which development policies pertaining to specialized equipment must be based. The military officer who combines these qualifications for any given arm is rarely to be found, and it is even less likely that he can meet these requirements in all the arms together. As the number of war-experienced officers available for this type of assignment diminishes, the assurance of sound review will become proportionately less. This represents a serious weakness in the organizational structure at the field force level.

c. During the development phase, the close coordination between the using agency and the development facility which is so essential to effective follow-up does not receive the encouragement which it should. The funds for this purpose are not always sufficient, or, if the funds are available, the need for following through on the part of those who formulate military characteristics is not fully appreciated. To accomplish such coordination by correspondence is too slow and indirect to be wholly satisfactory.

d. Another deficiency which tends to aggravate the difficulties which are met in the integration of civilian assistance with the Army's research and development objectives is the large turn-over of military personnel connected with the work. Continuity of liaison, collaboration, and policy suffer, and all problems become magnified as a result.

e. A final and overriding factor which has failed to receive the recognition due it is the necessity for proper coordination and supervision of the individual efforts of the several agencies whose responsibilities in given fields of development are frequently inter-related. For example, in the field of fire control, the agencies

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involved in the development of one item may include the Ordnance Department, the Signal Corps, the Corps of Engineers, the Chemical Corps, Army Field Forces, and the U.S. Air Force. An analysis of a number of projects made by one of the Army Field Forces boards in 1948 indicated that the lack of an adequate mechanism for coordination and supervision resulted in the following shortcomings:²⁴

- (1) Delay in translating improved procedures into field practice.
- (2) Failure to provide urgently needed equipment.
- (3) Failure to push development of urgently needed equipment.
- (4) Failure to adjust T/O&Es to meet definitely established requirements.
- (5) Delay in revision of doctrine and technique.
- (6) Failure to provide suitable equipment for use with authorized tactical maps.
- (7) Lack of coordination between the Air Force and Army Field Forces in the development and procurement of equipment intended for comparable purposes.
- (8) Development of weapons that are unsuitable for field force use.
- (9) Inadequate basic research.

4. Summary.

a. The machinery for providing using agencies with necessary technical information upon which to base preliminary studies connected with the determination of requirements for new materiel is inadequate.

b. The specialized nature of the combat arms branches and the importance of the equipment intended for their use demand the most highly qualified talent for the evaluation of results of studies and tests of such equipment.

c. The importance of coordination of user and developer during all stages of development requires increased emphasis.

d. Assignment of military personnel to research and develop-

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ment functions should be stabilized to the maximum possible extent in order to assure effective collaboration of military and civilian agencies and to minimize disruption of organization and policy.

e. Many of the shortcomings of the existing research and development procedure are due to the lack of coordination and supervision of interrelated responsibilities connected with the various fields of interest.

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~~UNCLASSIFIED~~PROPOSED REORGANIZATION FOR RESEARCH AND DEVELOPMENT1. Introduction.

a. Despite the post-war trend toward the integration of the combat arms and the elimination of branch-consciousness, there are aspects of the trend which merit further study. An important consideration is the specialized nature of our three combat arms: the infantry, the artillery, and the armored cavalry.

b. Although the arguments which brought about the abolition of the branch chiefs early in 1942 were valid ones, the underlying cause of the difficulties which had been encountered prior to that time was not in the organization per se, but rather in the failure of the general staff to effect the necessary coordination. It was this failure which made it possible for the Chiefs to be thorns in the flesh of the high command, and for one Branch Chief to carry on a desperate rear-guard action for years on behalf of the horse. It must be admitted, however, that the advanced state of development of our weapons and techniques during the war can be attributed directly to the momentum of the influence of the Branch Chiefs.

c. The branch system as it existed prior to 1942 had its flaws, and it is not the purpose of this study to propose its re-establishment. However, in the light of the analysis presented in Annex 4, in which the general nature of the deficiencies in the existing organization and methods have been uncovered, ~~it~~ the way should be clear to the formulation of a program designed to correct those deficiencies.

2. The essentials of effective integration.

a. Accepting as a premise that the combat arms are distinctive specialties, using specialized techniques and requiring special equipment and training, it follows that the determination of policies, the formulation of programs, and the supervision of the execution of those programs require a directing influence or instrumentality

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which embraces a well-rounded experience and knowledge of all the elements peculiar to the branch and matters closely related to it.

b. In addition to an agency which will bring a thorough knowledge of the art to the problems of the branch and a personal sponsorship of proposals, there must be an over-all authority which will provide an impartial, detached, analytical viewpoint which the specialists are apt to lose because of their proximity to the problems. Such an agency would determine general policies and objectives and would concentrate on broad direction, coordination among the branches, and control. It would devote its full time to the broad interests of the combat arms as a whole. The agency just described now exists in the Chief, Army Field Forces.

c. Under the present structure, the Chief, Army Field Forces, also performs the function of the specialized agency mentioned in subparagraph a., above. It is held, however, that the time, ability, and comprehension of a single individual is inadequate to fulfill this function and that the staff organization provided is not qualified to furnish the specialized assistance and advice which he needs.

3. Proposed solution: Combat Arm Councils.

a. It is proposed that a combat arm council be established for each of the branches. The purpose of the councils would be to perform the staff functions required to supplement the responsibilities and duties of the Chief, Army Field Forces, as set forth in SR 705-5-1. These funtions would include:

- (1) Determination of requirements
- (2) Formulation of plans and objectives
- (3) Review, coordination, digest, and passing expert opinion on proposals
- (4) Keeping the Chief, Army Field Forces informed of trends in developments
- (5) Coordination and supervision of research and

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operations of direct concern to the branch

b. The membership of each council would comprise the following:

Commanding General, the branch Center, President
Assistant Commandant, the branch school
President, appropriate AFF Board or Boards
Directors, appropriate Service Test Sections
Selected representatives of Developments Section, OCAFF
Members of appropriate committees of R&D Board
Selected representatives, Technical Group, OCAFF

c. The proposed membership as outlined above appears to parallel the organization of the technical committees to a certain extent. We may consider, however, that participation on the technical committees is on the strategic level, whereas participation on the branch councils is on the tactical level; and that, whereas technical committee action includes the establishment of technical requirements and the processing of procurement programs, the council action will stress the determination of requirements for the using services and the coordination and supervision of development activities on their behalf for the purpose of insuring the integration of science, industry, and the military agencies concerned throughout the development chain.. Only through a membership embracing all these aspects of development can effective integration be achieved. The Council would meet at the call of the president thereof to resolve questions of significance. Routine matters would be handled by the senior branch representative permanently assigned to the Developments Section, OCAFF.

d. Appendix 7 shows the organizational and functional structure of the proposed councils and their relationship to the Chief, Army Field Forces.

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18. Steelman, op. cit.
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- 23. Most of the material in this annex is based on the personal experience and observations of the author during two years of service as a member of Army Field Forces Board No.1.
- 24. General Concept of the Problem Involved in Improving the Accuracy of Predicted Fire, AFF Board No. 1, Fort Bragg, N. C.

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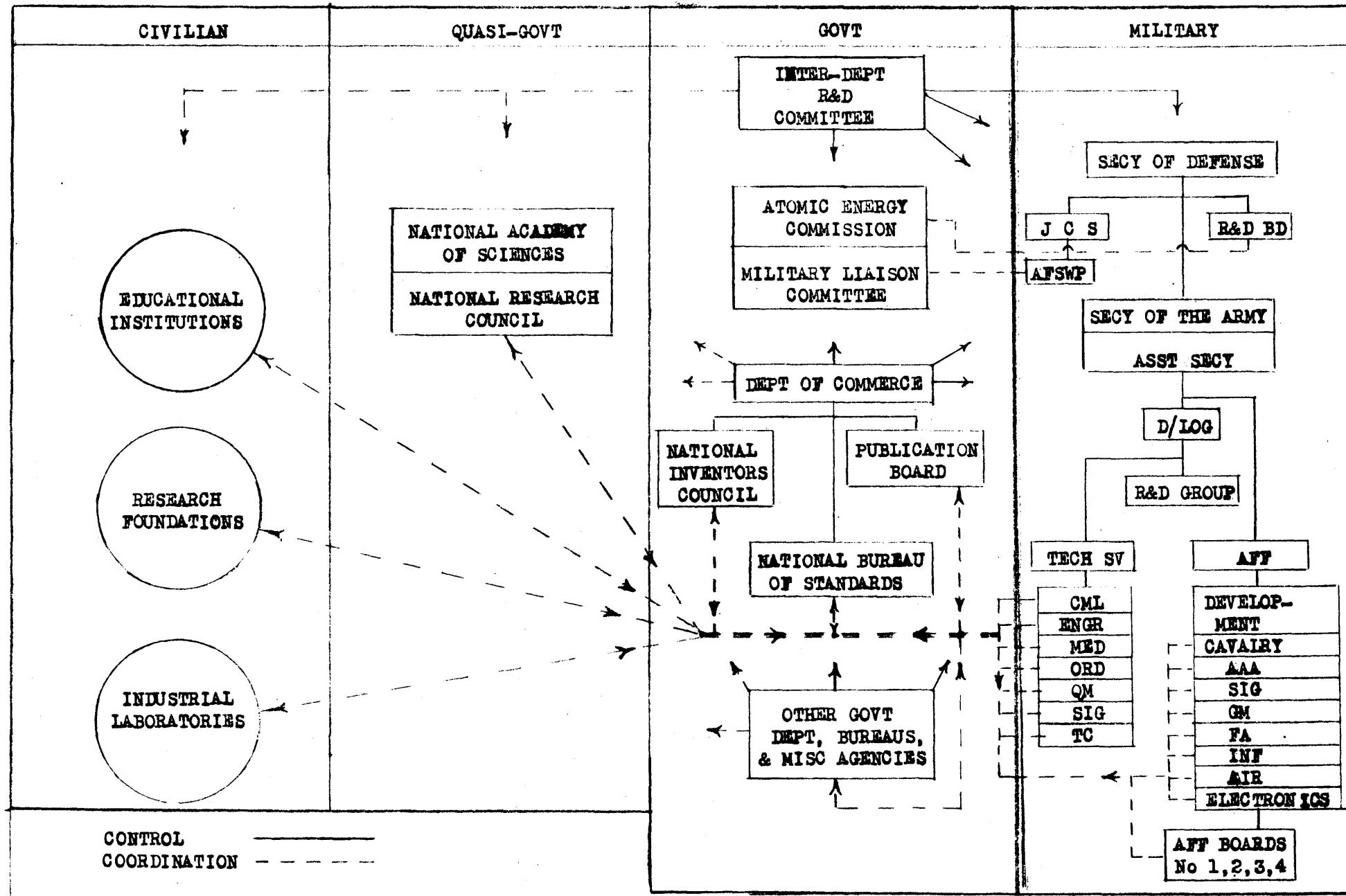
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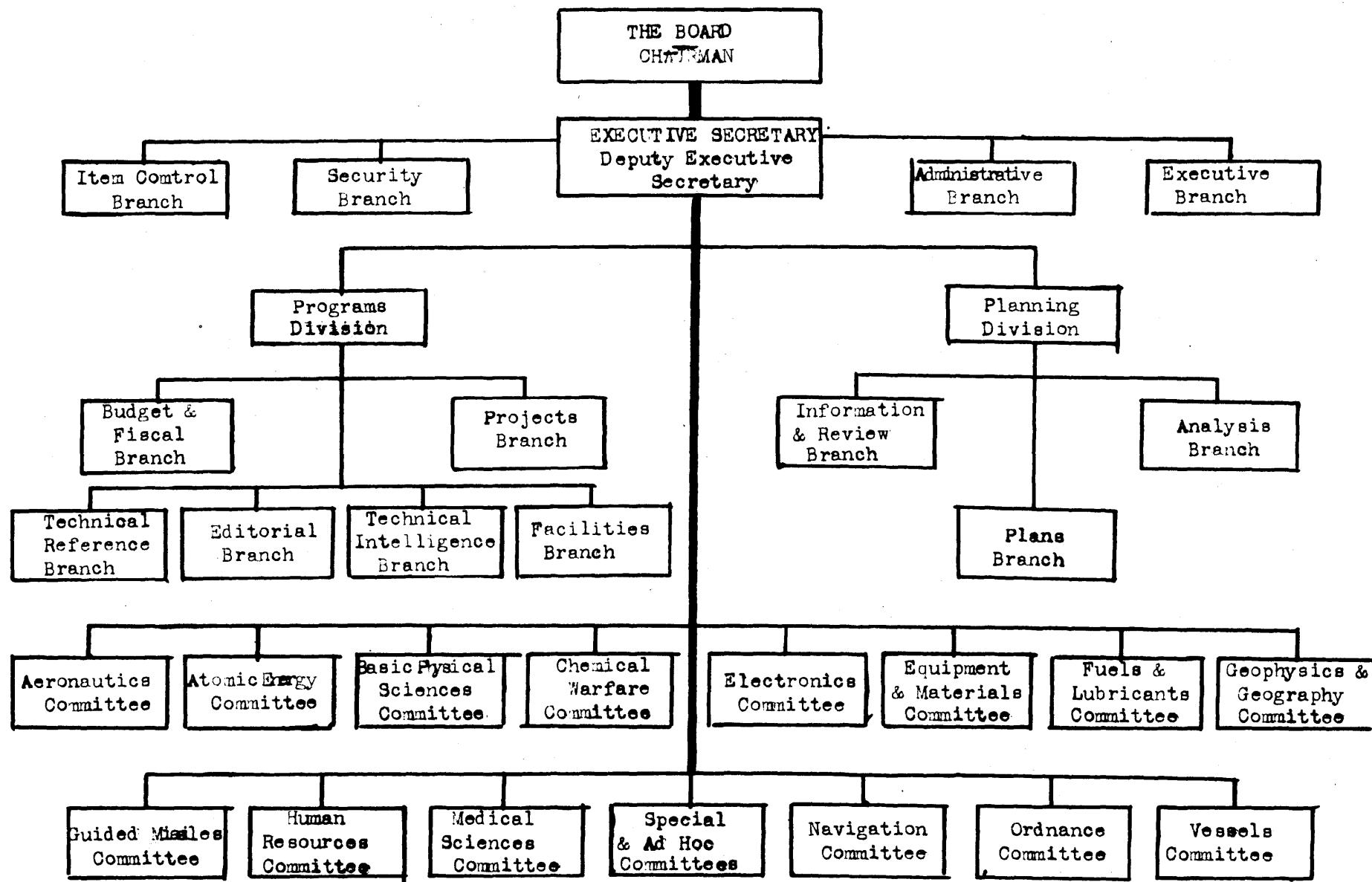
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AGENCIES AFFECTING THE ARMY R&D PROGRAM



RESEARCH & DEVELOPMENT BOARD

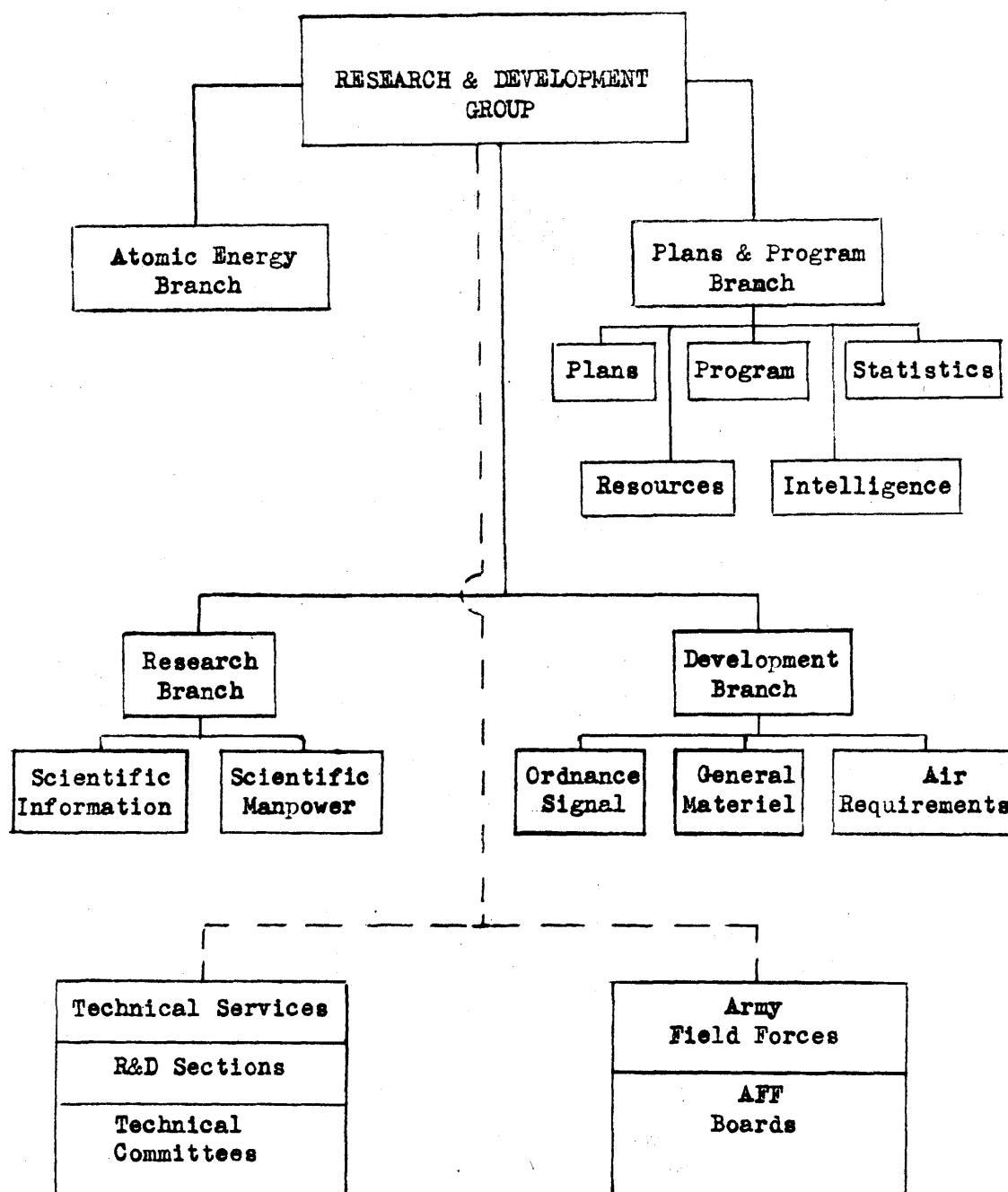


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RESEARCH & DEVELOPMENT GROUP

LOGISTICS DIVISION

GSUSA



Command Channels _____
Coordination Channels - - -

APPENDIX 3

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CHIEF OF
ORDNANCE

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GS USA

R & D Group

AFF

Developments
Cavalry
AAA
Signal
Guided Mis-
siles
FA
Infantry
Air
Electronics

Other Techni-
cal Services

Cml
Engr
QM
Med
TC

Allied and
Other US Arms

Navy
Marine Corps
British
Canadian
Air Force

ORDNANCE TECHNICAL
COMMITTEE

Membership-- Using
Arms and Chiefs of
major services and
divisions of Ordnance
Department.

General Functions--
Consider and recom-
mend technical ac-
tion on all matters
affection Ordnance
Materiel intended
for Army and relat-
ed matters.

ORDNANCE

TECHNICAL COMMITTEE

Industrial
Services

Manufacture
Procurement

R & D

Conducts R&D
Programs

Field Service

Stores, issues
and maintains
standard items

Military
Service

Trains Ordnance
personnel for duties
involving
materiel

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RESEARCH & DEVELOPMENT PROCEDURES

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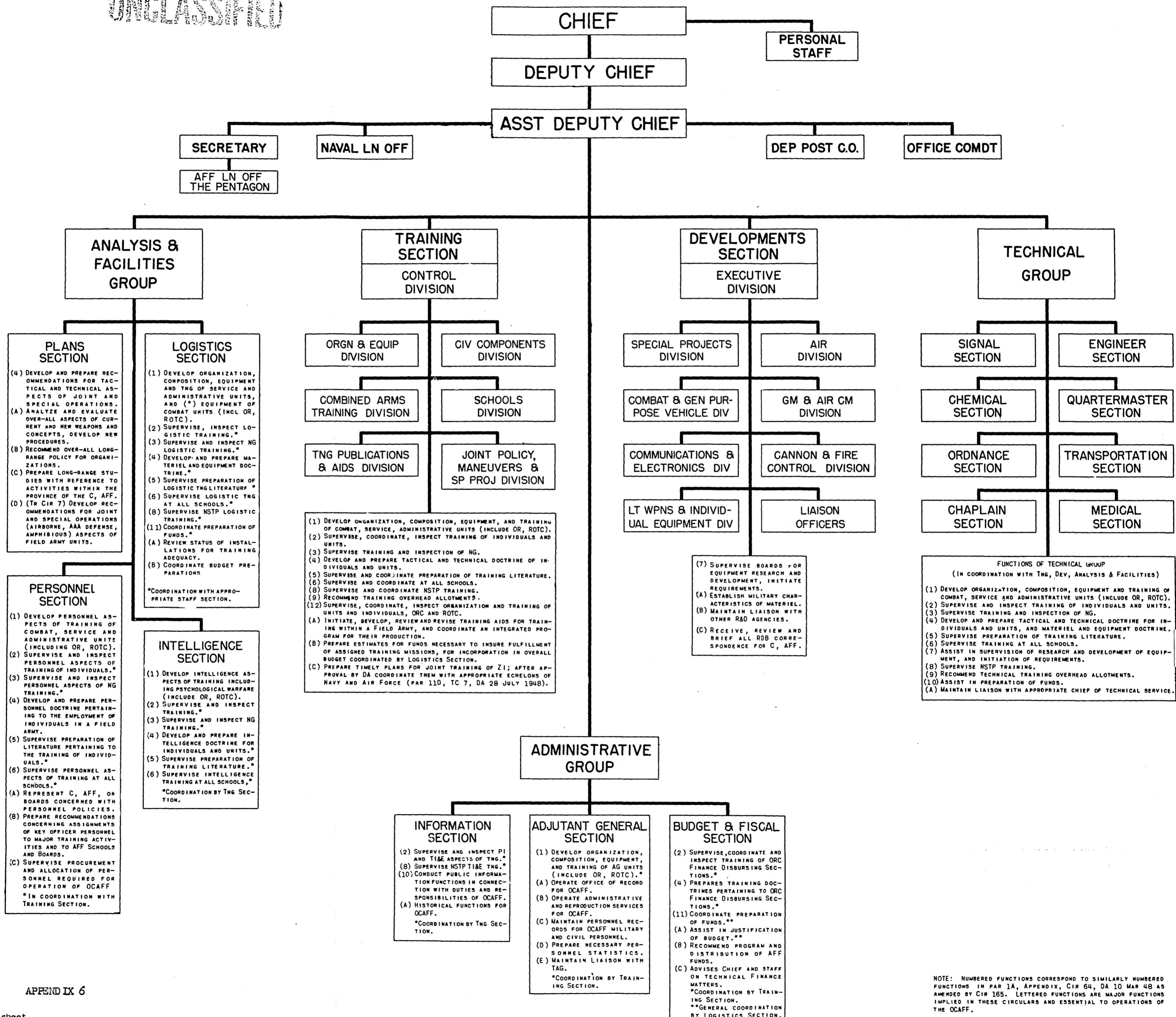
IDEAS	APPROVAL	PROJECT ASSIGNMENT	PILOT MODEL	SERVICE TEST	STANDARDIZATION
<p>MAJOR COMMANDS FIELD COMMANDS TECHNICAL SERVICES NATIONAL INVENTORS COUNCIL INDIVIDUAL CIVILIANS</p> <pre> graph LR A[MAJOR COMMANDS] --> D{Tech Services / Army Field Forces} B[FIELD COMMANDS] --> D C[TECHNICAL SERVICES] --> D D[NATIONAL INVENTORS COUNCIL] --> D E[INDIVIDUAL CIVILIANS] --> D D --> F[R & D Group] F --> G[Technical Committee] G --> H[Engineering Test] H --> I[Tech Service / Army Field Forces] H --> J[Technical Committee / R & D Group] </pre>	<p>Idea has merit. Military characteristics approved by R & D Group</p> <p>Approved military characteristics referred to the proper agency</p>	<p>Characteristics re- ferred to the proper agency</p>	<p>Work on pilot model done by technical service, civilian agency, or by modification of existing civilian or military item</p>	<p>Service test conducted by using agency and results in recommendation for standardization, cancellation, or modification</p>	

Technical Committee insures coordination between using and developing agency

Coordination with production agency to insure adaptability for quantity production and maximum interchangeability of parts

OFFICE, CHIEF, ARMY FIELD FORCES

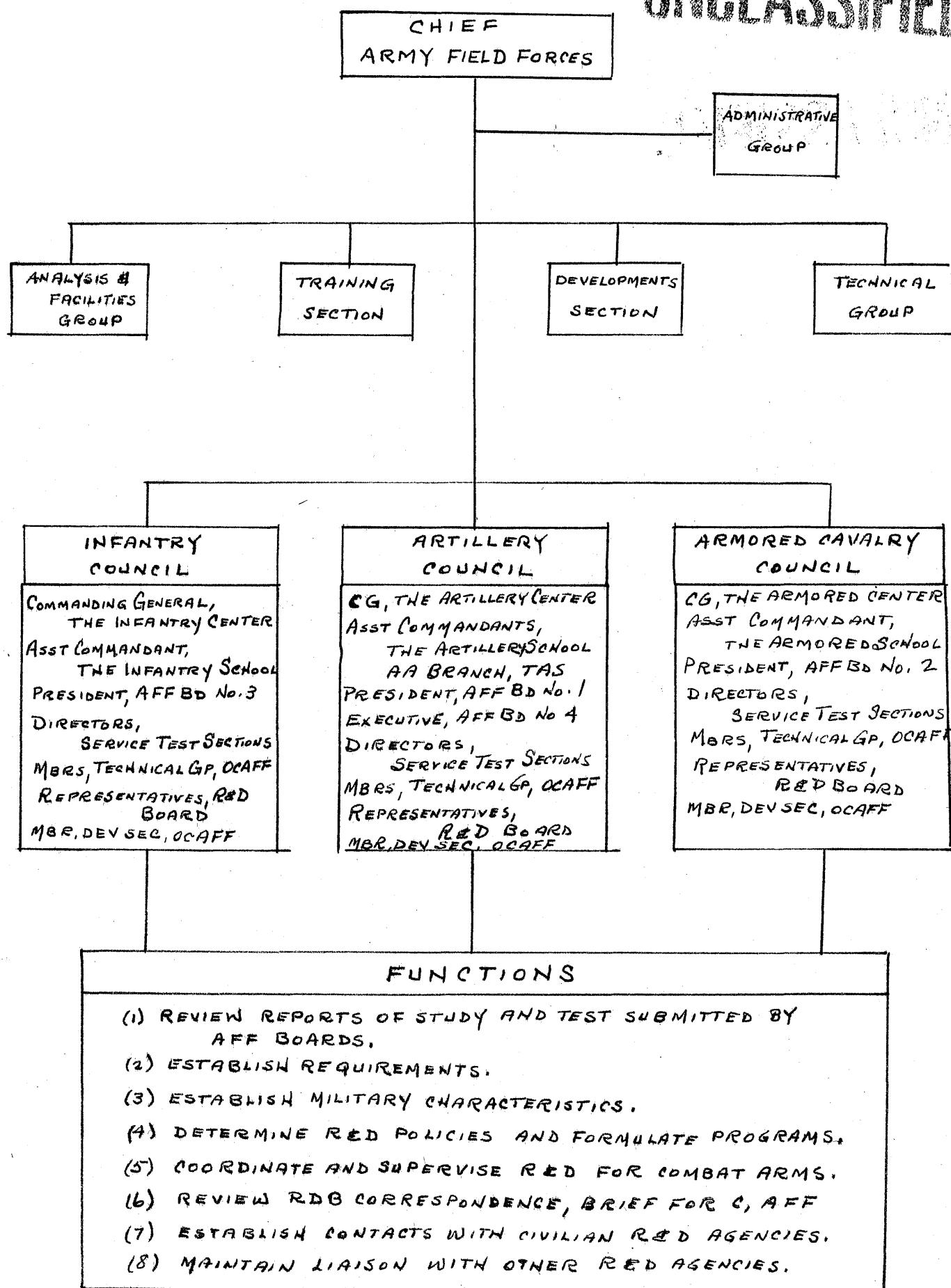
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BRUNSWICK

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**PROPOSED ORGANIZATION
AND FUNCTIONS
OF
COMBAT ARM COUNCILS**

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